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cooling goes on from the surface, and is far more rapid than the motion of the water to deeper layers: therefore ice is formed before the cooled masses sink to the depth and are replaced by warmer ones.

I can confirm Mr. Ashe's observation that the new ice frequently forms first on projecting points. It seems to me that particles of ice which have formed on the shore are driven by wind and waves into the sea, and act as so many centres of congelation. As these particles and small cakes are drifting before the wind, long, narrow streamers are formed, each new opening being rapidly filled by new ice. These narrow strips do not consolidate, but are driven to a lee coast, or their motion is stopped in some other way. Then they are pressed together, the small cakes are broken and overflowed by ripples, the water freezes on top of them, and within a short time an extensive field is formed consisting of numerous small cakes pressed and piled upon one another, and cemented by the water that has overflowed them. Besides this kind of ice, which is formed while the wind is blowing, smooth floes are formed in small bays during calm weather. The latter, however, form the smaller portion of Arctic ice. This process accounts for the great quantity of brine contained in the new ice. The deeper layers contain far less salt than the surface ice, as the mechanical admixture of water takes place on the surface only. The snow, on falling on this kind of ice, forms a slush, as it melts in the brine oozing out of the ice. This mixture freezes, and thus the thickness of the ice increases on the upper and lower sides simultaneously. The different origins of the layers of ice accounts for their different character.

During the winter the ice undergoes remarkable changes. The brine contained in ice of different depths is the more concentrated the lower the temperature of the layer. It is probable that the cavities between the ice-crystals are sufficient to effect a gradual decrease in the concentration of the upper parts, which then begin to freeze, and thus become drier.

When in spring the ice begins to melt, it loses its salt rapidly, and I observed in latitude 70° north, on the west coast of Baffin Bay, that it had become entirely fresh about the end of June, the brine being removed through the capillary cavities.

A remarkable effect of mechanical action upon the dissipation of the sea-water ice may be observed at places where rapid tides are running. When the temperature of the air rises to about —20° C. (—4° F.), the ice becomes saturated with water, and is being worn off at its lower side. It seems that the lower surface of the ice is rough, consisting of ice-needles with isolated points. These are broken off by the violent motion of the water, and thus by the friction of the broken pieces the volume of the ice-sheet is continually being diminished at its lower side. In winter the same process must be going on, though not to so great an extent. Some places of this kind are open throughout the winter. Their extent is changing according to the strength of the tides; and during the spring-tides ice of about fifteen or twenty centimetres thickness, which was formed during the preceding neap-tide, is broken up and pressed under the neighboring floe: consequently the thickness of this ice would continually increase if it was not worn off at its lower surface. In fact, the ice in such places is very treacherous and thin: therefore it seems, that, according to the strength of the current, a certain low temperature is required to resist its destructive influence. Below the layer which has this temperature the ice is saturated with water and being worn off.

Mr. Ashe touches upon another subject the explanation of which seems to me insufficient. On steep coasts in the Arctic regions an ice-wall is found attached to the rocks, and reaching from high-water to low-water mark, gradually decreasing in thickness, and having a vertical side. When the tide ebbs, the wet rocks are exposed to the cold air, and of course are covered with a thin sheet of ice. This process begins before the sea is frozen over, and, as the water is still agitated by winds, the thickness of the layer formed during a single tide is considerable. This process is going on throughout the winter, and thus this ice-foot continues to increase in width. At spring-tide its level is overflowed by water, which adds to its height. It is characteristic of this ice-foot that the unbroken land-floe extends to its foot, a single crack separating the two masses. Cliffs which are washed by water throughout the winter have frequently no ice-foot at all. This shows that the floe favors its formation.

The ice on shores with a gradual slope is quite different. Here it is not attached to the bottom, as Mr. Ashe's description would imply, but originates in the following way. The ice which is formed on the surface at high water strands during the ebb-tide, and its volume is increased by the freezing of the water left on the beach. When the tide comes in again, the greater part of this ice begins to float, increases in thickness, and strands again on the rocks. By the repeated breaking of these masses on the rocks, the water is frequently exposed to the air, freezes, and thus the thickness of the ice is far more rapidly increasing than that of the unbroken floe. It is continually growing on all sides, new material being also added on the sides, and thus a heavy pressure results which affects the neighboring parts of the floe, which is frequently pressed under the level of the sea, is overflowed, and thus increases in thickness. If the slope is sufficiently gentle, this part of the floe strikes also the rocks at low water, and is added to the growing belt of grounded broken ice that surrounds the coast. Similar forms of ice are found on mud-beaches, and I believe that such is the origin of the unusually heavy mud-colored masses of Fox Basin, which is known to be extremely shallow.

The formation of the ice-foot which was described above is similar in origin and appearance to the frozen freshets which in winter form ice-walls that are firmly attached to the steep cliffs. This proves that Mr. Ashe's explanation of this fact is not correct, and that fresh water as well as sea-water may freeze firmly to the ground.

DR. FRANZ BOAS.  
New York, Aug. 19.

#### The Geologists' Congress.

PERMIT me to say a word concerning the generally fair and full report, in *Science*, of the proceedings in Section E of the American Association. By a typographical error, a clause in the conclusion of the digest of the reporter on the Archæan is made to read "American geologists will acquiesce in the recommendations of the committee," etc. 'Congress,' not 'committee,' was the word used. Again, "the recommendation that all pre-Cambrian rocks should be called Archæan savors too much of pre-judgment, especially in view of the recent studies of Irving and Walcott."

These studies, which have resulted in the theory called by Professor Walcott, in his letter to the reporter, 'Prof. R. D. Irving's view,' were very carefully considered in the body of the report. The sentence above gives no idea of the entire recommendation; of how far it differs from the view of Irving, Chamberlin, Walcott, and others; nor of why it seems to best reconcile the conflicting views expressed by American geologists. 1st. The term 'Archæan' as originated by Dana received the unanimous suffrages of the Berlin Congress, and, so far as the reporter could ascertain, has the indorsement of a very large majority of American geologists as a general term to cover all pre-Cambrian rocks. Irving would separate these rocks into two divisions of equal rank: to the lower (Laurentian) 'Archæan' should be applied, the upper (separated by a physical break from the first, and containing an unspecified number of smaller breaks or unconformities) he would erect into a new group of equal rank with Archæan in its new sense, and would call it, after Chamberlin, 'Agnotozoic.' He recognizes "great unconformity between the Cambrian and the Agnotozoic, besides which there are minor, though still quite extensive, unconformities between the members of the Agnotozoic itself." It is evident, from the tenor of all the views expressed on this proposed new division, that its exact rank is not certainly understood. All who recognize it believe that it has at least as high a rank as 'Paleozoic,' 'Mesozoic,' etc., but none can yet affirm that it may not consist of several such groups, divided by one or more of these 'extensive unconformities.' In view of this fact, and also of the circumstance that to a vast majority of geologists to-day the Archæan includes all pre-Cambrian rocks, it was thought that the recommendation of the reporter avoided, to the greatest degree, any pre-judgment of this question. It is as follows:—

"The division first in order of time shall have a rank of the first order, and shall be called 'Archæan.' (a) It shall comprehend all the rocks of origin anterior to the Cambrian. (b) The lowest subdivision of the Archæan shall be called the 'Laurentian.' (c) A division between the Laurentian and the Cambrian, provisionally

including the Huronian, Grand Cañon, Llano, Montalban, and Taconian (of Hunt), Animikie, and other divisions, shall be accorded a name different from any of these (such as 'Eozoic' or 'Proterozoic'), and allowing the greatest amount of liberty in the future, when it shall be determined whether this division shall be entitled to rank as one or several of the first order having numerous subdivisions as above mentioned, or with, or including, any of them of the second order like the class Laurentian. No attempt shall be made at this time to pre-judge this question, and these names and this classification shall be regarded simply as the best that can be accomplished at the present time."

This plan would seem to be possible of acceptance both by those who, like Dr. Hunt, recognize many divisions, and by those who recognize but two. The only sacrifice of individual opinion required would be as to the rank of such divisions, which the reporter doubted whether any geologist wished unreservedly to affirm. When the exact rank of the proposed new division is generally accepted, if it be a group, the now all but universally accepted word 'Archæan' can be dropped or otherwise assigned.

As to the resolution approving the action of the committee, if it only received two or three affirmative votes, it is equally true that it received no negatives.

Philadelphia, Aug. 25.

PERSIFOR FRAZER.

#### The Pronunciation of 'Arkansas.'

I HAVE read with much interest Mr. Robert T. Hill's vigorous protest, in the last number of *Science*, against the mispronunciation of this word. Nevertheless, it seems to me that Mr. Hill, whose personal acquaintance with New England is comparatively recent, has been unintentionally not quite fair to "intelligent New England circles," in making them responsible for the "later and improper pronunciation." I am a New Englander by education, myself, and was taught, before I went to school, to pronounce the word properly. In school, however, our teachers insisted on the 'revised version.'

I am pretty well convinced that the mispronunciation was the invention of a class of school-teachers, unfortunately too common in New England, whose training for teaching the 'English branches' is so specialized as to carefully exclude every thing relating to foreign languages (including even the English of *Old England*). Not a few other examples might be quoted of similar 'school-ma'am' pronunciations. 'Glou-ces-ter' and 'Wor-ces-ter' are beginning to replace the proper sounds among the younger generation of 'common-school' scholars in New England, at least, and 'Norwich' and 'Harwich' are well established. It seems to me that we really do need more such protests as Mr. Hill's, before the rage for anglicizing does away with the historical pronunciation of more of our geographical names.

In regard to the word 'Cheyenne,' I suspect that Mr. Hill has laid the blame on the wrong shoulders. How the western plainsmen (who, one would suppose, would have inherited the correct pronunciation, or something like it, from the old *coureurs de bois*), came to call the 'Dog Soldier' band of Indians 'shy-ens,' instead of 'chiens' I cannot say. I do know, however, that this was the established plains pronunciation. We can scarcely blame the New England lexicographers, — or whoever first wrote the word, — therefore, for failing to recognize the French word under the universal Western pronunciation.

JOHN MURDOCH.

Smithsonian Institution, Aug. 27.

#### Eskimo and the Indian.

IN an article on the Eskimo of East Greenland in the current number of the *American Naturalist* (p. 749), it is stated that the eminent savant Dr. Rink has recently advanced the idea that the 'kayak' of the hyperborean American aborigines is but a development from the birch-bark canoe of the neighboring Indian tribes. In glancing through Petitot's 'Tchiglit (Mackenzie River) Dictionary,' I found what seems to be a confirmation of this theory. In the Tchiglit dialect the word for boat is *kayark*, and the bark of the birch used for canoes (*écorce du bouleau à pirogues*) is called *kreyrork*. A comparative study of the Eskimo and the neighboring Indian dialects must certainly result in adding considerably to our stock of knowledge regarding the interesting Innuits. A few ex-

amples of Eskimo loan-words may be given here. In the dialect of the Eskimo of Churchill River the word for 'dead' is *nipa*, which agrees with *nipiw* (Cree), *nip* (Chippeway), etc., being entirely foreign to the stem *tok*, which pervades the Eskimo dialects from Cape Farewell to the Anadyr. One of the Tchiglit words for 'rain' is *nipaluk*, evidently related to the Cree *nipi* (water). In Algonkin we find this series: *nipa* (moon), *nip* (die), *nipi* (water); and it is worthy of attention that this peculiar concatenation is repeated with the Eskimo of whom I am speaking, viz., *nipa* (dead, in Churchill River dialect), *nipaluk* (rain, i.e., water, in Tchiglit), *niptartvark* (a Tchiglit term for moon). In the far west we find the words *madsschak* (sun, in Kadiac), *matschak* (sun, in Anadyr Tchuktchi), *madje* (sun, on Kotzebue Sound), *madzak* (star, in Kadiac), which bear a suspicious resemblance to *maitsaca* (moon, in Tarahumara), *matzake* (moon, in Cora), *mecha* (in Cahita), and *metztli* (in Aztec), and would seem to indicate the great northward extension of Aztec influence along the coast of the Pacific. Thorough research will no doubt reveal much that is interesting and valuable in this regard.

A. F. CHAMBERLAIN.

Toronto, Aug. 25.

#### Sea-Water Ice.

IN *Science* for August 19, under the heading 'The Formation and Dissipation of Sea-Water Ice,' Mr. Ashe, in speaking of the formation of ice along the shore, and the accumulation of films of ice upon that which is submerged, makes the following statement: "Over this, at the surface of the water another film is formed, which, on reaching the level of the submerged ice, is frozen to, and remains with it in this position. This operation is repeated till the result is that a perpendicular wall of ice forms, whose outer limit is the low-water mark, terminated by a horizontal surface shorewards, at the limit of high-water mark."

If it is meant to convey the impression, as it would naturally be supposed, that this is so in all parts of the world, I must flatly contradict the statement for Cape Prince of Wales, Hudson Strait, where I was stationed, at the head of a sandy bay, during the winter of 1885-86, with the object of watching the formation and dissipation of sea-water ice. Here the distance between high and low tide mark was about three hundred yards, and, although some ice did adhere to the sand, it always came to the surface in irregular pieces shortly after the tide had risen above it. These pieces were often piled one upon another by the force of the wind, accumulated, and as the winter advanced they rose to the surface in larger masses, until the ice in the bay had reached a variable thickness under three feet, when the whole mass floated at each rising of the tide as one piece, only cracking in a few places, and, with the exception of its rough surface, no change of level could be noticed between it and the ice always floating beyond low-tide mark.

A higher tide than usual always forced its way through, within a few feet of high-tide mark, the ice cracking with a loud report here and there along the shore, the water again returning through these cracks when the tide began to fall.

Late in January a hole was cut through the ice between high and low tide mark, when the sand was found to be perfectly soft, in which living shell-fish were found.

F. F. PAYNE.

Toronto, Aug. 23.

#### Answers.

14. AN EXPULSION OF SPARROWS. — It was probably a flock of 'white-bellied swallows' that W. A. G. saw circling about his house on Staten Island, but they in no way caused the disappearance of the sparrows as intimated. These swallows are here now in great numbers, perching on telegraph wires and along the seashore on beach, plum, and bayberry bushes, and on hazy mornings many may be seen flying south along our shore line. As to the English sparrows, a few still remain about the houses, but this is their season of flocking, and in some fields, especially where grain has been raised, they abound. I once knew of a double row of elms where these birds congregated afternoons in late summer, and chattered in great convention until the sun went down. They were gathered from a large circle of country, and I think that W. A. G. will find a similar meeting place, where the missing sparrows will be assembled.

WM. T. DAVIS.

Tompkinsville, S.I., Aug. 29.